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Where the GLOBAL PET FOOD INDUSTRY does business

#petfoodforum

Considerations for supplementing omega-3s in companion animal diets

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April 28-30, 2025, Kansas City, Missouri, USA

Learning Objectives

1. Understand the **metabolism and physiological roles** of n-3 and n-6 FA in dogs and cats
2. Review **current published recommendations** for these FA and **research investigating the n-6:n-3 ratio** across life stages in dogs and cats
3. Evaluate the **environmental sustainability and practicality** of different n-3 FA sources available to the pet food industry

Importance of fats

Concentrated source of energy

Taste and texture of food

Help absorb vitamins (A, D, E and K)

Source of essential fatty acids

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Fats as a source of essential fatty acids

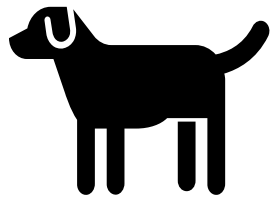
Dogs and cats can synthesize many fatty acids from:

- Bacterial synthesis
- Amino acids
- Glucose

But cannot:

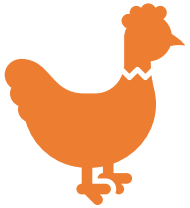
- Synthesize omega-6 (Ω-6) and omega-3 (Ω-3) fatty acids
- Cannot convert between families (Ω-6 ⇹ Ω-3)

Essential fatty acids



Omega-6s

Linoleic Acid (LA)



Arachidonic Acid (AA)

Pro-inflammatory signaling molecules

Omega-3s

Alpha Linolenic Acid (ALA)

Eicosapentaenoic Acid (EPA)

Docosahexaenoic Acid (DHA)

Anti-inflammatory signaling molecules

Δ-6 desaturase

Δ-5 desaturase

Δ-4 desaturase

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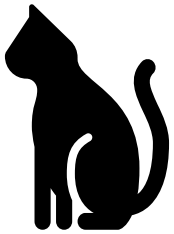
Essential fatty acids



Omega-6s

Linoleic Acid (LA)

Δ-6 desaturase

Δ-5 desaturase

Arachidonic Acid (AA)

Δ-4 desaturase

Pro-inflammatory signaling molecules

Omega-3s

Alpha Linolenic Acid (ALA)

Eicosapentaenoic Acid (EPA)

Docosahexaenoic Acid (DHA)

Anti-inflammatory signaling molecules

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Dietary sources of omega-6 and omega-3 fatty acids

Omega-6s

Linoleic Acid (LA)

- Corn oil
- Soybean oil
- Sunflower oil

Omega-3s

Alpha Linolenic Acid (ALA)

- Flaxseed oil
- Camelina oil

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Safety of Dietary Camelina Oil Supplementation in Healthy, Adult Dogs

by Scarlett Burron [1], Taylor Richards [1], Keely Patterson [1], Caitlin Grant [2], Nadeem Akhtar [1], Luciano Trevizan [3], Wendy Pearson [1] and Anna Kate Shoveller [1,*]

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[*] Author to whom correspondence should be addressed.

Animals **2021**, *11*(9), 2603; https://doi.org/10.3390/ani11092603

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Dietary sources of omega-6 and omega-3 fatty acids

Omega-6s

Arachidonic Acid (AA)

- Poultry fats (chicken and duck)
- Beef tallow
- Some fish oils (ie: menhaden)

Omega-3s

EPA & DHA

- Fish oil (incl. menhaden, herring, salmon etc)
- Algal oil

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Essential fatty acid requirements

AAFCO	Canine		Feline	
	Growth & Reproduction	Adult	Growth & Reproduction	Adult
LA (Ω-6)	1.3 %	1.1%	0.6%	0.6%
ALA (Ω-3)	0.08%	--	0.02%	--
AA (Ω-6)	--	--	0.02%	0.02%
EPA + DHA (Ω-3s)	0.05%	--	0.012%	--
Ω-6:Ω-3 ratio	<30:1	<30:1		

DHA and puppies

- DHA necessary for brain and retinal development in-utero and after birth
  - Puppies fed ↑ DHA, or whos moms fed ↑ EPA + DHA during pregnancy and lactation: improved vision, memory and learning ability

(Zicker et al. 2012; Heinemann et al. 2005)

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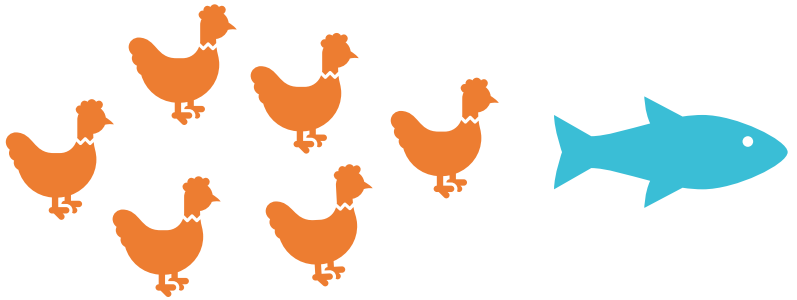
Ω-6:Ω-3 ratio	<30:1	<30:1		

Ratio of omega-6 to omega-3 fatty acids (Ω-6:Ω-3)

- Measure of the balance between these two different families of fatty acids found in the diet
  - Compares quantity of omega-6 fatty acids (Ω-6: LA + AA) to the quantity of omega-3 fatty acids (Ω-3: EPA + DHA)

If quantity of Ω-6 in diet
7 x more than Ω-3 →
Ω-6:Ω-3 = 7:1



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Ratio of omega-6 to omega-3 fatty acids (Ω-6:Ω-3)

- Synthesis of Ω-6 (AA) and Ω-3 (EPA + DHA) from plant-derived fatty acids (Ω-6:LA, Ω-3:ALA) requires the same enzymes
  - Competition for enzymatic pathways and signal molecule production
- Have opposing effects
  - Ω-6s: inflammatory
  - Ω-3s: anti-inflammatory

Ω-6:Ω-3 and inflammation

- ↓ dietary Ω-6:Ω-3 may help with management of inflammation and inflammatory conditions such as osteoarthritis and dermatitis

Immune response

ELSEVIER

Veterinary Immunology and Immunopathology
69 (1999) 165–183

Veterinary immunology and immunopathology

www.elsevier.com/locate/vetimm

- Healthy young and old dogs both had improved immune response to a dietary Ω-6:Ω-3 of 5:1 vs. 25:1

Effect of age, breed and dietary omega-6 (n-6) : omega-3 (n-3) fatty acid ratio on immune function, eicosanoid production, and lipid peroxidation in young and aged dogs

Robert J. Kearns[a,*], Michael G. Hayek[b], John J. Turek[c], Mohsen Meydani[d], John R. Burr[b], Robert J. Greene[b], Craig A. Marshall[b], Scott M. Adams[b], Robert C. Borgert[b], Gregory A. Reinhart[b]

[a]*University of Dayton, Dayton, OH 45469, USA*
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[c]*Purdue University, Lafayette, IN 47907, USA*
[d]*Tufts University, Boston, MA 02111, USA*

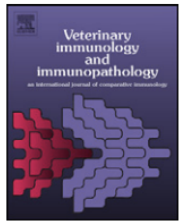
Skin and coat health

- Dietary Ω-6:Ω-3 of 5:1 vs. 20:1 improved fur color, shine and softness
- Reduced skin inflammatory responses to histamine in healthy cats

Contents lists available at ScienceDirect

Veterinary Immunology and Immunopathology

journal homepage: www.elsevier.com/locate/vetimm



Short communication

Dietary fish oil and flaxseed oil suppress inflammation and immunity in cats

Hyun Joo Park[a], Jean Soon Park[a], Michael G. Hayek[b], Gregory A. Reinhart[b], Boon P. Chew[a,*]

[a] School of Food Science, FSHN 110, Washington State University, Pullman, WA 99164-6376, USA
[b] P&G Pet Care, Lewisburg, OH 45338, USA

Ω-6:Ω-3 and inflammation

- No clear recommendation on ideal Ω-6:Ω-3 for dogs or cats
- Evidence that:
  - Ω-6:Ω-3 between 5:1 - 10:1 → effective in altering tissue fatty acid composition and helping with the management of inflammation in healthy animals
  - Ω-6:Ω-3 < 5:1 → may be beneficial for animals with inflammatory conditions

Osteoarthritis

Multicenter veterinary practice assessment of the effects of omega-3 fatty acids on osteoarthritis in dogs

James K. Roush, DVM, MS, DACVS; Chadwick E. Dodd, DVM; Dale A. Fritsch, MS; Timothy A. Allen, DVM, DACVIM; Dennis E. Jewell, PhD, DACAN; William D. Schoenherr, PhD; Daniel C. Richardson, DVM, DACVS; Phillip S. Leventhal, PhD; Kevin A. Hahn, DVM, PhD, DACVIM

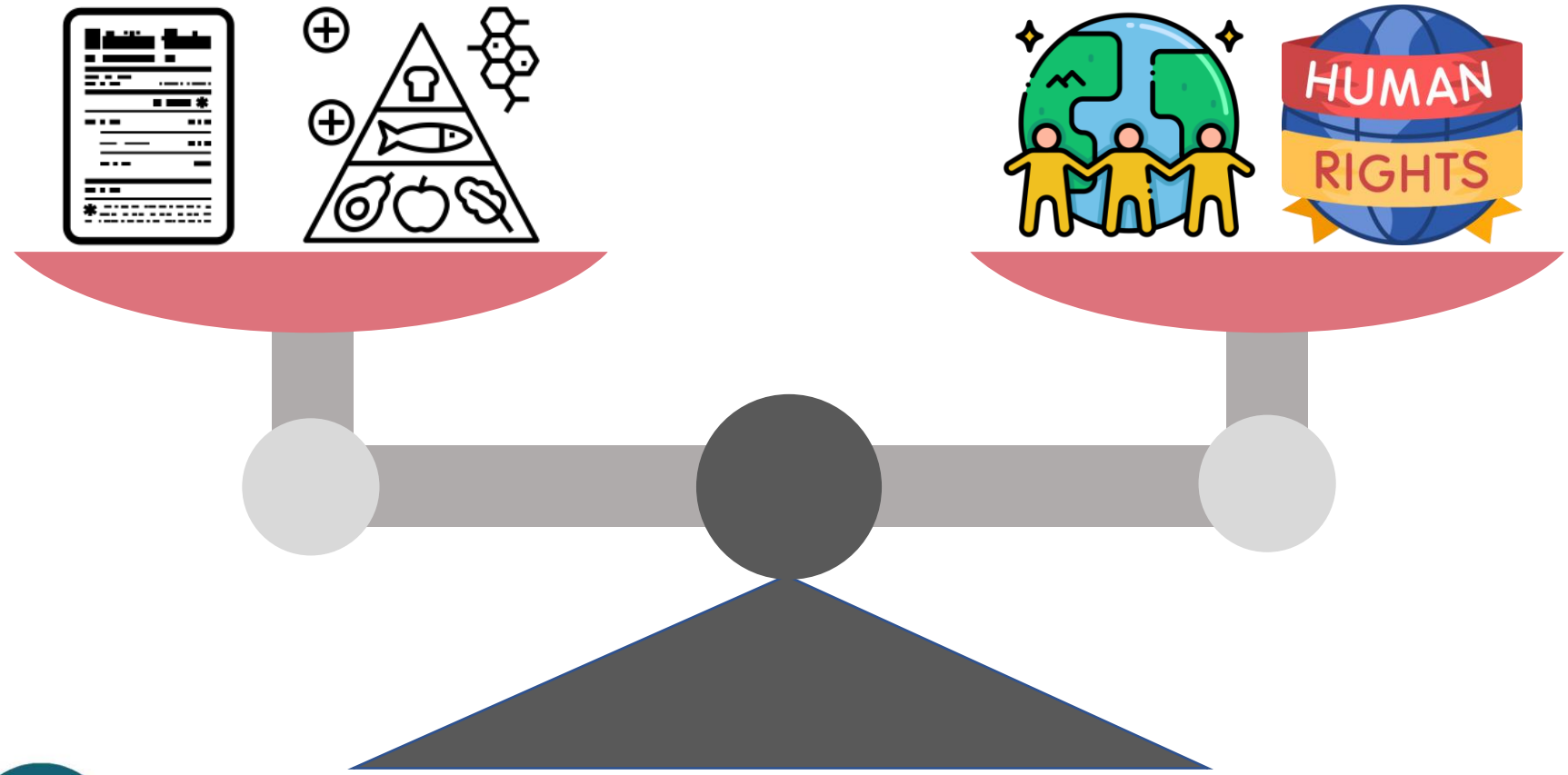
- Owners of dogs consuming dietary Ω-6:Ω-3 of 0.7:1 reported improved ability to rise from a resting position, ability to walk and play vs. dogs consuming Ω-6:Ω-3 of 24:1

Risks of excess omega-3 fatty acids

- Delayed wound healing
  - ↓ blood clotting → excess bleeding
  - ↓ skin regeneration
- Altered immune function
  - ↓ white blood cells
- Weight gain or failure to lose weight

Looking ahead: What is the (not so distant) *future* of sustainable fat supply?

Ingredient choices are a balancing act



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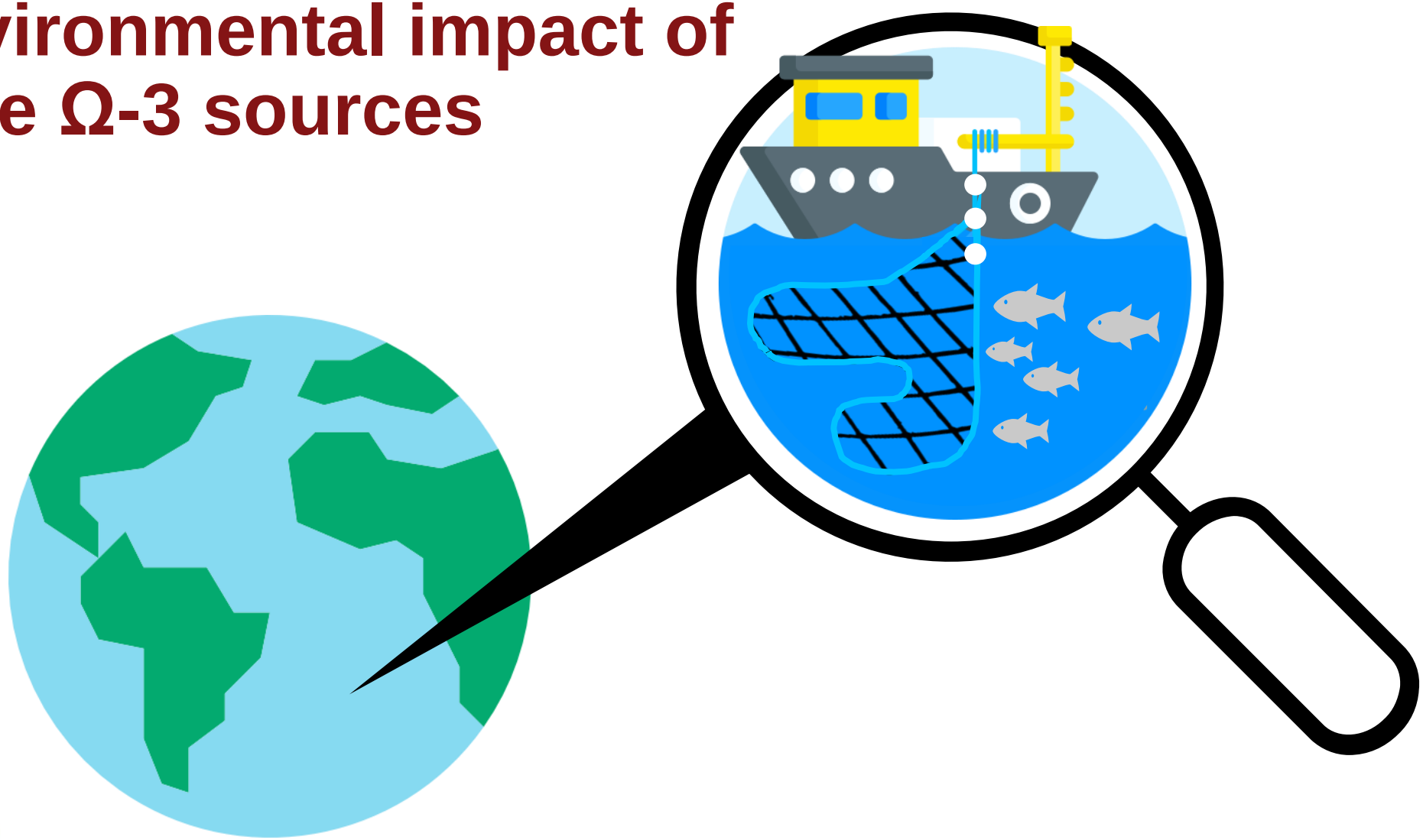
Consider environmental impact of marine Ω-3 sources



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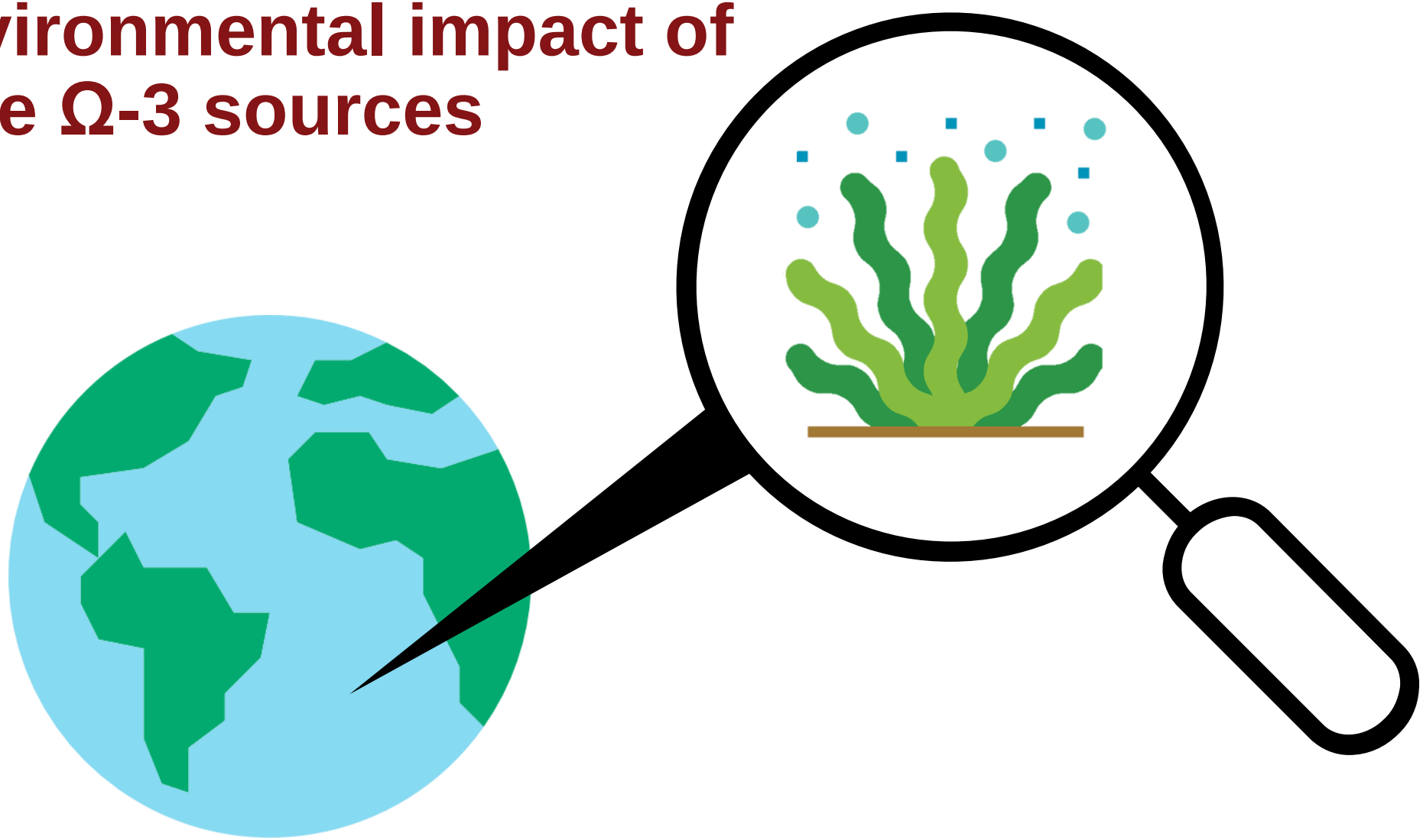

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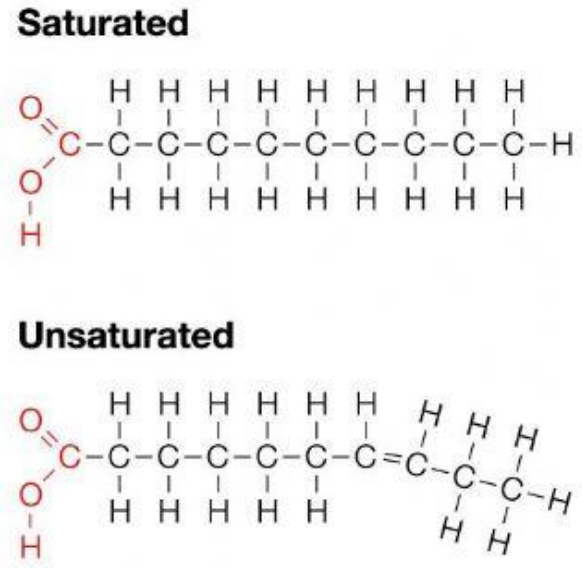
Must also consider lipid oxidation and shelf life

- Polyunsaturated fatty acid (PUFA)-rich oils more susceptible to oxidation vs. fats rich in saturated fatty acids (SFA)
- Oxidation influenced by:
  - Internal factors (ie: nutrient profile)
  - External factors (ie: heat, light)



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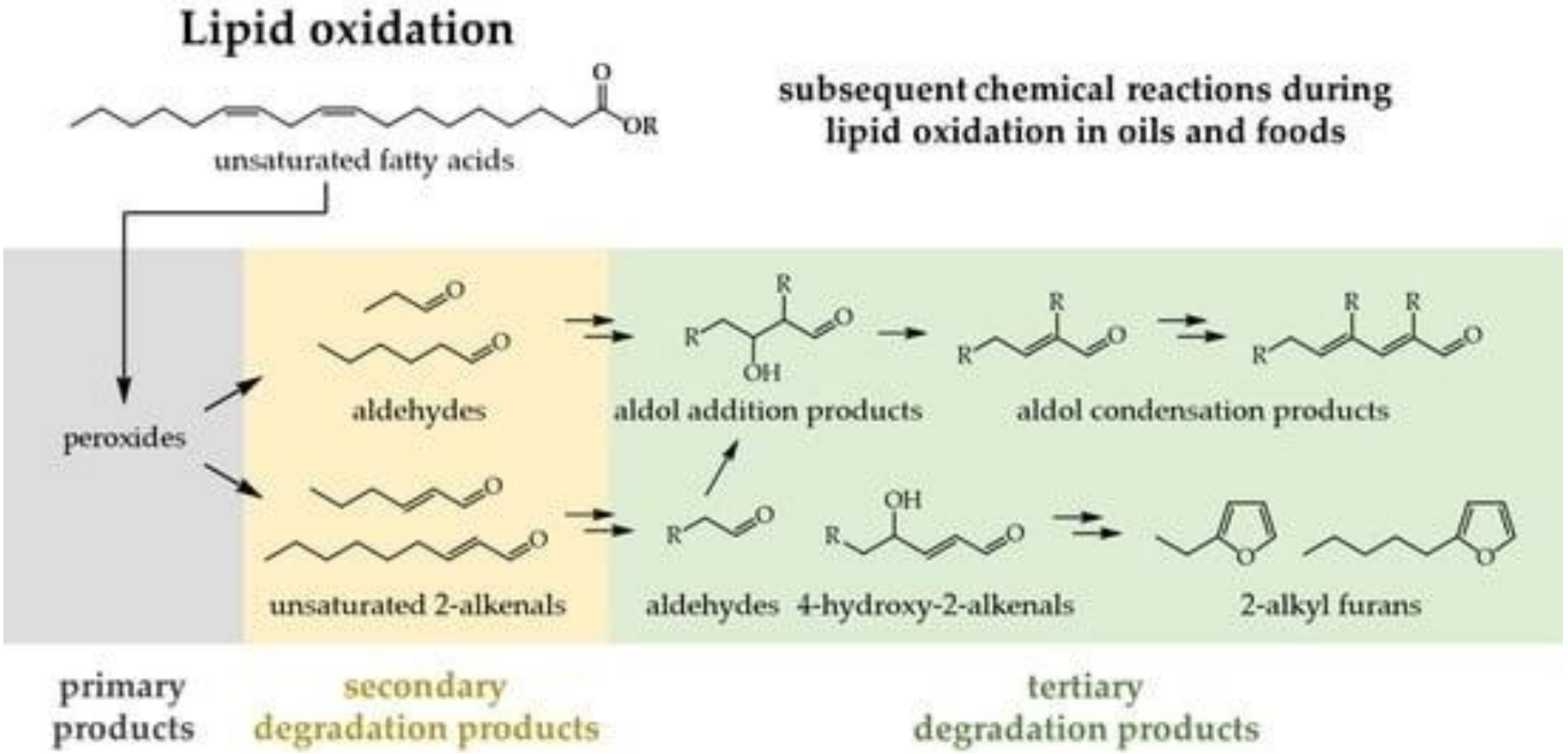
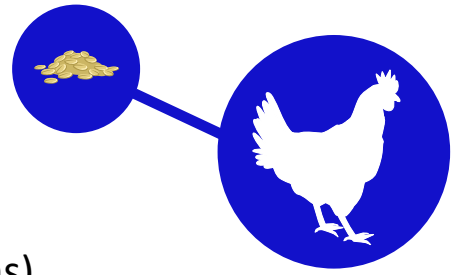


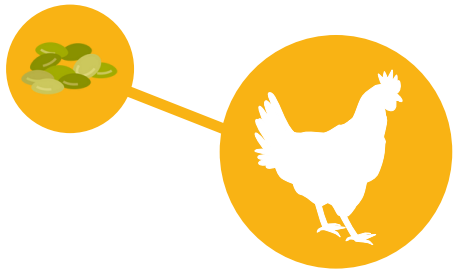
(Grebenteuch et al. 2021)

Research investigating lipid oxidation and shelf life

- Objectives:
  - To assess how the oxidative stability of kibble differs in accelerated storage conditions based on the degree of saturation of oil it is enrobed in

2 Kibble Formulas
(with and without grains)





Grains

Pulses

10 oil/fat treatments + uncoated control

1 2 3 4 5 6 7 8 9 10 CON 1 2 3 4 5 6 7 8 9 10 CON

Champion Petfoods™
World's Best Petfood

2 Kibble Formulas
(with and without grains)

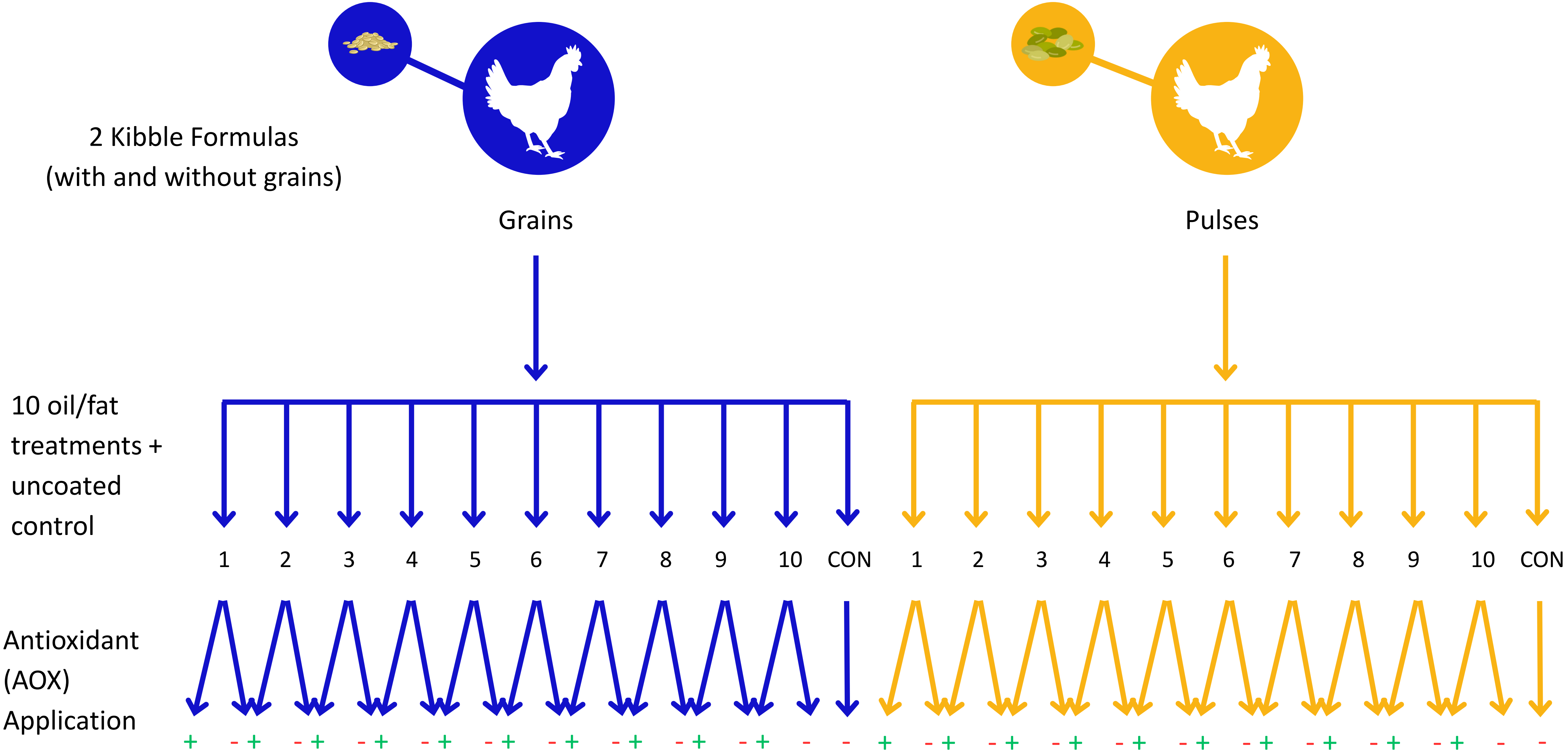
Grains

Pulses

10 oil/fat treatments + uncoated control

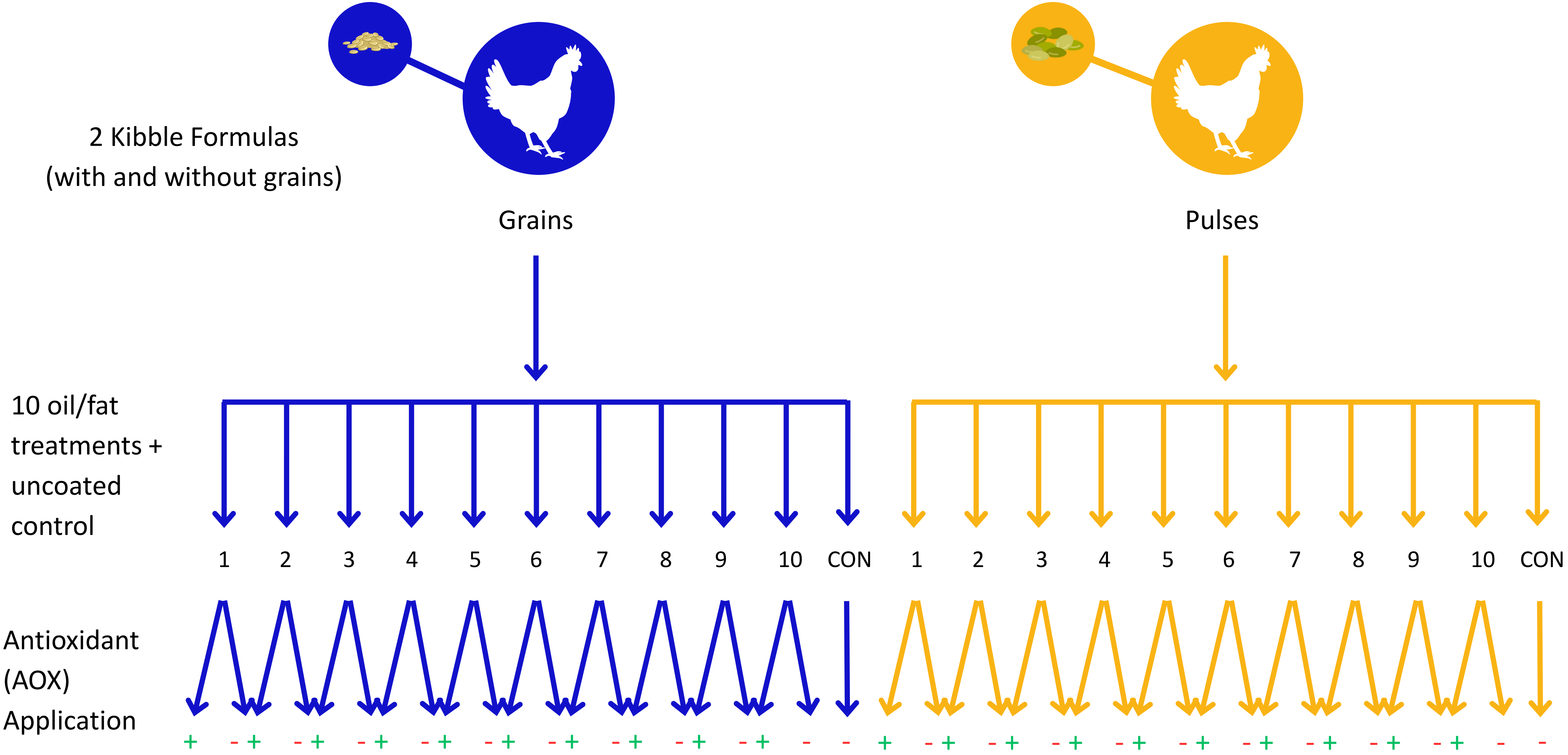
FA profile rich in	Oil/Fat Treatments	
PUFA - EPA/DHA (Ω-3)	Fish (Pollock) Oil	Algae Oil
PUFA - ALA (Ω-3)	Flax Oil	Camelina Oil
PUFA – LA (Ω-6)	Sunflower Oil	Canola Oil
SFA	Chicken Fat	Duck Fat
SFA + medium chain FA	Coconut Oil	Black Soldier Fly Larvae (BSFL) oil

CON



Antioxidant: Mixed tocopherols + rosemary oil (NATUROX R30, Kemin Industries) applied to external coating at 200 ppm diet

30



42 TREATMENTS TOTAL

Ambient Storage and Testing

- Samples stored in plastic bags at ambient conditions for 15 months
- Baseline + testing every 3 months of samples for:
  - Peroxide Value (PV)
  - Secondary Aldehydes: Hexanal and 2.4-Decadienal

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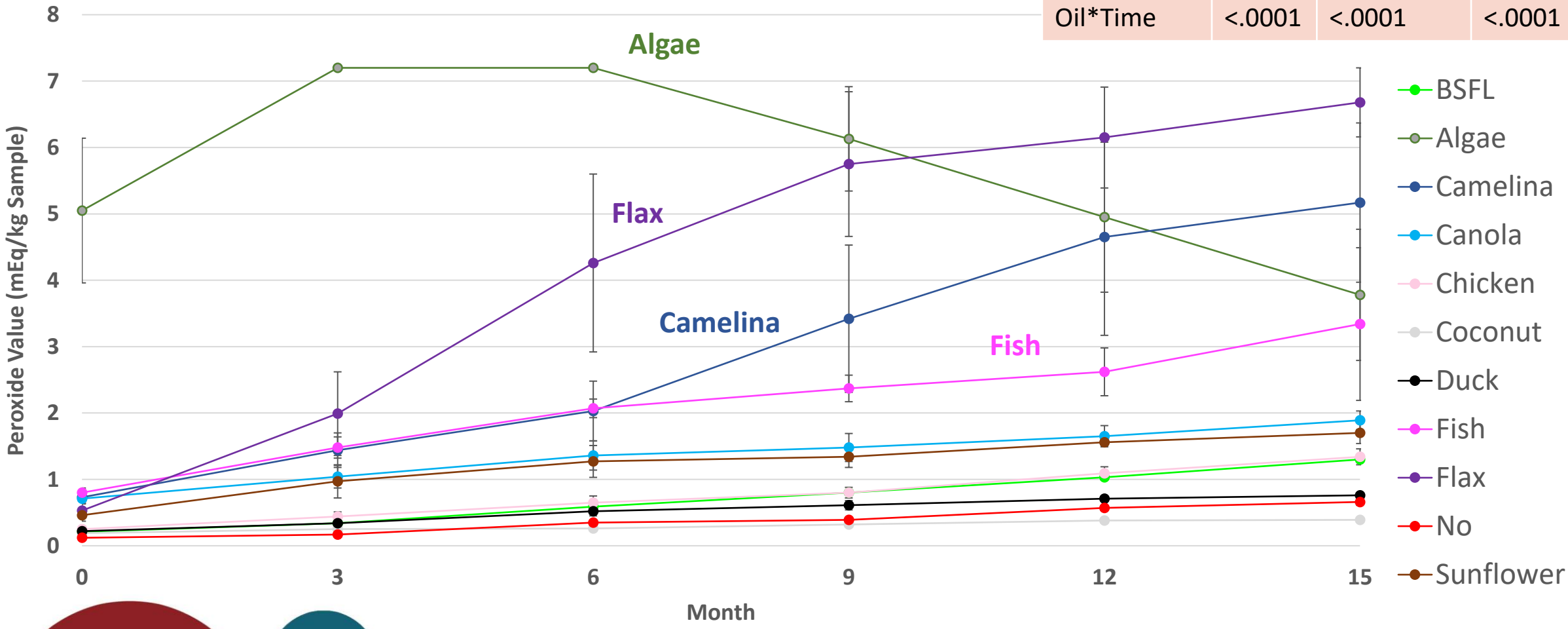
PUFA-rich oils oxidized more than SFA-rich fats

	PV	Hexanal	Decadienal
Oil	<.0001	<.0001	<.0001
Time	<.0001	<.0001	<.0001
Oil*Time	<.0001	<.0001	<.0001



PUFA-rich oils oxidized more than SFA-rich fats

	PV	Hexanal	Decadienal
Oil	<.0001	<.0001	<.0001
Time	<.0001	<.0001	<.0001
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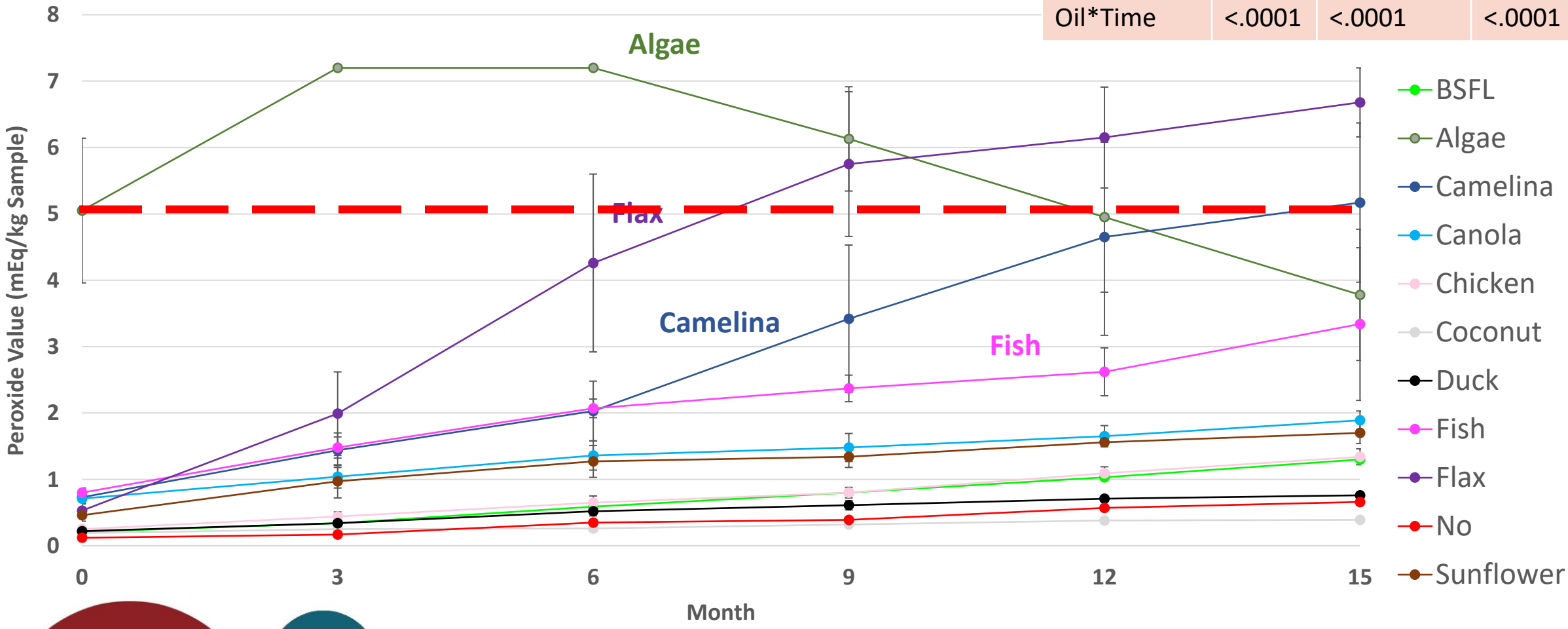

Ingredient choices are a balancing act

- Algae oil considered more environmentally sustainable option for providing EPA and DHA vs. fish oil
  - However, oxidative stability must be considered
  - Lipid oxidation = especially important consideration for immunocompromised pets

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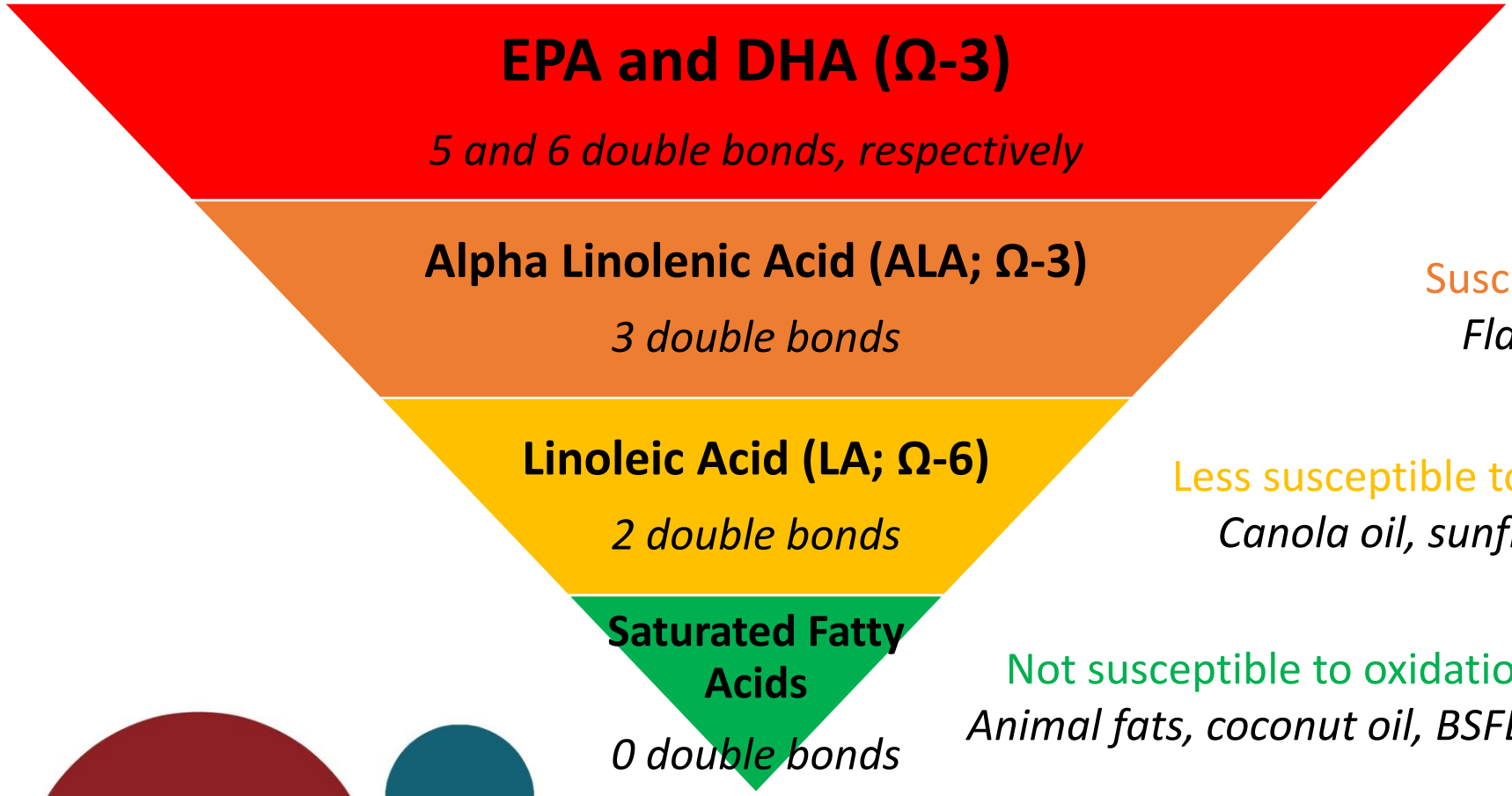
Oxidation related to degree of unsaturation (# double bonds)

Ingredients rich in:



Most susceptible to oxidation
Fish oil, algae oil

Susceptible to oxidation
Flax oil, camelina oil

Less susceptible to oxidation
Canola oil, sunflower oil

Not susceptible to oxidation
Animal fats, coconut oil, BSFL oil

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Considerations for ALA

- ALA will support the endogenous production of EPA in dogs
  - Additional EPA/DHA supplementation only needed during certain life stages, such as growth/reproduction or in certain disease states
- Beneficial effects of ALA on inflammation may be independent of its conversion to EPA and DHA (Anderson and Ma, 2009)

Considerations for ALA

- Inclusion of EPA or DHA-rich ingredients in excess is not warranted given the practical limitations in terms of sustainability
- Reliance on a single fat source will not be sufficient in meeting the essential and conditionally essential FA recommendations of a dog or cat - oil(s) rich in both LA and ALA should be provided

Acknowledgements

NSERC
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Thank you!

Questions?

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